

## Model version 0

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**! Lingo model Ex3;**

**! Peter Lohmander 171110;**

**model:**

**! Initial conditions;**

**V0 = 300;**

**PA0 = 20;**

**! Other parameters;**

**PA1 = 20;**

**c = 50;**

**PB1 = 0;**

**PB2 = 0;**

$$r = 0.03;$$

$$r2 = 0.03;$$

$$a = 0.05;$$

$$K = 400;$$

$$\text{Prof1} = \text{PA0} * (\text{V0} - \text{V1}) - c;$$

$$\text{Prof2} = (\text{PA1} * (\text{V2} - \text{V1}) - c) / (@\text{exp}(r * t) - 1);$$

$$\text{Prof3} = \text{PB1} * \text{V0} * 1 / r2;$$

$$\text{Prof4} = (\text{V2} - \text{V1}) / t * (\text{PB2} * 1 / r2 + \text{PB1} * 1 / (r2 * r2));$$

$$\text{Prof} = \text{Prof1} + \text{Prof2} + \text{Prof3} + \text{Prof4};$$

$$@\text{free}(\text{Prof1});$$

$$@\text{free}(\text{Prof2});$$

**@free(Prof3);**

**@free(Prof4);**

**@free(Prof);**

**t>5;**

**t<50;**

**V1>20;**

**V1 < V0;**

**V2 = 1/(1/K+(1/V1-1/K)\*@exp(-a\*t));**

**max = Prof;**

**end**

## Results from version 0

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**Local optimal solution found.**

<b>Objective value:</b>	<b>6397.031</b>
<b>Infeasibilities:</b>	<b>0.000000</b>
<b>Total solver iterations:</b>	<b>38</b>
<b>Elapsed runtime seconds:</b>	<b>0.04</b>

<b>Model Class:</b>	<b>NLP</b>
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<b>Total variables:</b>	<b>7</b>
<b>Nonlinear variables:</b>	<b>3</b>
<b>Integer variables:</b>	<b>0</b>
<b>Total constraints:</b>	<b>10</b>
<b>Nonlinear constraints:</b>	<b>2</b>
<b>Total nonzeros:</b>	<b>19</b>
<b>Nonlinear nonzeros:</b>	<b>5</b>

Variable	Value	Reduced Cost
V0	300.0000	0.000000
PA0	20.00000	0.000000
PA1	20.00000	0.000000
C	50.00000	0.000000
PB1	0.000000	0.000000
PB2	0.000000	0.000000
R	0.3000000E-01	0.000000
R2	0.3000000E-01	0.000000
A	0.5000000E-01	0.000000
K	400.0000	0.000000
PROF1	4993.625	0.000000
V1	47.81876	0.000000
PROF2	1403.406	0.000000
V2	120.4430	0.000000
T	23.09396	0.000000
PROF3	0.000000	0.000000
PROF4	0.000000	0.000000
PROF	6397.031	0.000000

# Sensitivity analyses

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	PROF*	V1*	t*	V2*
M0	6397	47.8	23.1	120.4
M1 ( $r=r_2=0.02$ )	7577	82.8	19.2	162.2
M2 ( $PB1=0.5$ )	13598	97.7	17.7	175.9
M3 ( $PB1=2$ )	36480	144.4	11.6	201.0
M4 ( $PB2=10$ )	7645	82.6	19.6	163.7